For complete list of publications of the Indian Meteorological Department see the covers of Monthly Weather Reviews prior to January 1909, or the lists bound up with the Annual Summaries from 1906 onwards.

(a) *Relationship wi[th]*

It was noticed by the author in 1906 that a year of high pressure in India tends to be followed by an abundant southwest monsoon, and the correlation coefficient of the two quantities when based on data of the years 1875 to 1906* was found to be +·5. When in 1910, however, data as far back as 1865 were included this coefficient fell to +·25† which was not large enough to justify the use of the pressure factor in monsoon forecasting, and it was accordingly omitted in the memoir ‡ in which were described some applications of statistical methods to seasonal forecasting. The coefficient from 1865 to 1912 is only +·2; it will be seen from Figure I, however, that the agreement has almost certainly been too persistent to be due to accident, and it appears likely that the rainfall data from 1865 to 1874 before this Department was started, though roughly correct, were less accurate than those of subsequent years. If these years be given two-thirds the weight of the subsequent years the coefficient becomes ·25 with a probable error of ·1, and the relationship, though not close, becomes worthy of some consideration.

2. The reliability of the early pressure data may first be considered. From 1864 to 1867 the most trustworthy observations are those of Calcutta, Bombay and Madras; and, as is clear from a reference to Tables II, III and Figure 2, between 1875 and 1912 the mean of those annual departures from normal agrees so closely with that of India as a whole that the mean may be taken as representing the pressure departure of India to a fairly satisfactory degree of accuracy. For the period 1868 to 1874 the data utilised have been those of Calcutta, Roorkee, Bombay and Madras; and in 1875 the Meteorological Department came into existence, so that after this the number of stations available is amply sufficient to secure correct data. As regards monsoon rainfall, however, the number of stations affording information begins at 201 in 1865 and increases to 355 in 1874: and under such conditions perfect accuracy cannot be expected. We can effect a partial check of the data by comparing them with the official list of famines and scarcities given in the Imperial Gazetteer of India, Volume III (1907), pages 501-2, and also by comparing them with the index numbers of the prices of food in the successive years. § Both these sources of information suggest between 1865 and 1875 a deficient rainfall in 1865, 1868 and 1873, and the latter source suggests good rains in 1867, 1869, 1870 and 1874. The data satisfy these tests well except that in 1865 the deficiency appears smaller than might have been

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* See the *Memorandum on the conditions before the monsoon of 1907*, pages 1-2. Here however the rainfall data were not given weight according to the area represented, and this had the effect of incorrectly increasing the correlation coefficient.

† The values of *correlation coefficients are in this paper only given to the nearest* ·05 in view of their probable errors of about ·1.

‡ 'Correlation in seasonal variations of weather, II.' Memoirs of the India Meteorological Department, XXI, Part II, 1910.

§ See Table XIII on page 68 of a paper on 'Rupee prices in India', by F. J. Atkinson in the Journal of the Royal Statistical Society, Volume LXXII, Part III, 1909.

anticipated. We can also form some idea of the reliability of the data by comparing the monsoon rainfall and pressure in the successive years. A reference to Figure 3 will show that since 1875 years of abundant rainfall have a strong tendency towards low pressure and *vice versa*, the correlation coefficient of monsoon rainfall to annual pressure of the same year being —·55. After consideration of the uncertainty regarding the data of 1865 to 1874 it appears on the whole better to attach to these years a weight of two-thirds of that given to the years since the Department was started; and this plan has been adopted through the present paper.

The resulting correlation coefficient is, as already stated, + ·25, while if the early period had been neglected and only the years 1875 to 1912 considered the result would have been + ·35, with a probable error in each case of ·1.

3. The most important feature of this factor is the early date at which it is available; and with the object of throwing light on the nature of this relationship the coefficients with the monsoon rainfall have been worked out for each month of the year of the rainfall, of the two years before and of the year after. The results are contained in Table IV and shown in Figure 4. From the latter it will be seen that a good monsoon tends on the average to be preceded by high pressure from August two years before to the December of the previous year, and that pressure tends to be low from January of the actual year to August of the following year. If the curve be smoothed it will be suggested that the period from October two years before to September one year before should have a fairly high positive coefficient; this however proves to be only +·25 with a probable error of ·1, and an identical result follows if we consider the period of ten months from November to the August of the year before the monsoon in question. The pressure data of this period are given in Table V and compared with the subsequent monsoon in Figure 5.

In all these cases, however, inasmuch as the correlation coefficient is only +·25 the indications are not sufficiently reliable to be of practical use in forecasting.

4. As already stated there is a strong tendency for the pressure of any year to be high when the monsoon rainfall of that year is deficient, and *vice versa*, and hence when using the pressure of any year as a basis for forecasting the rainfall of the next year it will be better if the known rainfall of the earlier year also is taken into account. Let r' and p' be the proportional departures* of the rainfall and pressure of the earlier year and r of the rainfall of the year which has to be forecasted; we then put

$$r = ap' + br',$$

and adopting the usual process† find

$$a = \cdot 38. \qquad b = \cdot 18,$$

while the correlation of the forecasted rainfall as given by this formula with the actual rainfall proves to be ·3. The results are plotted in comparison with the actual in Figure 6, and a reference to this will make it clear that the relationship is still not close enough for practical purposes.

* By the *proportional departure* of any quantity is meant the ratio of the actual departure to its mean value.

† See ' correlation in seasonal variation of climate,' Meteorological Memoirs, Volume XX, Part C, page 1913.

5. The data may however be handled in a different manner. A reference to Figure I will probably suggest a far closer relationship than is associated with a coefficient of $+\cdot 25$, and the explanation clearly lies in the fact that the curves of pressure and rainfall tend to move parallel to one another although at times their departures have opposite signs, *e.g.*, between 1902 and 1907 inclusive the parallelism is perfect, but the departures are of opposite signs in four years out of the six. We should accordingly expect a closer relationship between the successive differences in the annual values of rainfall and pressure than we have in the actual departures from normal of Figure I. These successive differences are plotted in Figure 7 and the correlation coefficient between them is as high as $+\cdot 6$, with a probable error of ·08.

In order to fix ideas it may be well to give an application. On the 1st January 1912 it was known that the pressure departures for 1910 and 1911 were —·013 and ·000, so that pressure rose by ·013 ; it would thus have been a legitimate inference that the monsoon rainfall would probably rise from 1911 to 1912, or that the rainfall of 1912 would be better than that of 1911.

Let us now consider the reliability of the indications. During the past 47 years when the numerical value of the pressure difference, apart from sign, has been ·010 or more, the sign of the difference in rainfall has been the same as that of the pressure difference 18 times and opposite only 4 times, of which 2 occurred in the somewhat inaccurate period 1866 to 1874. In about half the years therefore it would seem that we can obtain an indication whether the rainfall will be more or less than that of the previous year ; and, if past experience does not prove misleading, the indication may be expected to prove right four times out of five.

6. The unusual character of this relationship, between changes in departures and not in the departures themselves, suggests the desirability of further enquiry. Now let us suppose that in any year the proportional departures of rainfall and pressure are r and p, while in the *previous year* the values are r' and p', and in the year before that r'' and p'' ; then we know that the actual departures of rainfall exercise an influence on the pressures. Thus since the correlation coefficient between r and p is $-\cdot 55$, r may be expected to send down the proportional pressure departure of its year by $\cdot 55r$; similarly it may be expected to be associated with a rise in p' of the intermediate year amounting to $\cdot 25\,r$, and a fall in p'' of the first year of amount $\cdot 1r$.* In the same way r' will be associated with a fall in p' of the intermediate year, of $\cdot 55r'$ and a rise in p'' of by $\cdot 25r'$.† We should thus expect the pressure of the intermediate year to be higher than that of the earliest year by $\cdot 25r - \cdot 55r' + \cdot 1r - \cdot 25r'$,

or

$$+\cdot 35r - \cdot 80r' \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad (1)$$

or

$$\cdot 575\,(r-r') - \cdot 225\,(r+r').$$

Now it is easily seen that $(r-r')$ and $(r+r')$ are independent : for their correlation coefficient is the *mean* value of $(r^2-r'^2)$ divided by the mean values of $(r-r')$ and of $(r+r')$, and the mean value of $r^2-r'^2$ obviously tends to zero as the number of terms is increased. Hence from our previous knowledge of the relations between

* This is because the correlation coefficient between r and p'' is $+\cdot 1$.

† It may be noted that the correlation coefficient between r and r' is zero, so that they are independent.

rainfall and pressure, we should expect a correlation coefficient of ·575 between the rainfall increments and the pressure increments of section 5; and as this is, for practical purposes, identical with the coefficient of ·6 there given, it may be concluded that that section gives no information that cannot be deduced from our knowledge of the relations between the actual departures of rainfall and pressure.

The relationship between the increments of rainfall and pressure is thus valid enough; but if we consider the portion of (1) above which is concerned with r' alone, namely—·80r', we may put this in the form

$$\cdot 40\,(r-r')-\cdot 40\,(r+r'),$$

and may thus see that a coefficient of ·4 between the pressure change and the subsequent rainfall change is produced by rainfall r', which has already occurred at the time that the relationship might be used for forecasting. Thus of the relationship of ·6 only about ·17, or less than one-third, is concerned with r, the rainfall that has to be forecasted, and a forecast based on pressure differences would be of little practical use.

7. We have seen that from the expression

$$r=ap'+br'$$

we can only obtain a relationship of ·3 of the fore casted with the actual rainfall; and it remains to try

$$r=ap+br'+cp''+dr''.$$

On carrying out the computation the improvement in the relationship proves however to be inappreciable. It has therefore to be admitted that all these attempts to obtain a method of forecasting the general character of the monsoon five months or more before its arrival are unsuccessful.

(*b*) *The relation of Indian monsoon rainfall with Indian temperature in the previous May.*

8. It is generally, if not universally, held by meteorologists that India owes its monsoon rainfall to the fact that in the hot weather and rains the hottest region in the eastern hemisphere to the east of Africa consists of India, especially Sind and Baluchistan, and the southern parts of Arabia and Persia. Similarly in our cold weather north Australia is hotter than India and the Indian Ocean and monsoon rains make their appearance there. In both cases the heated air rises, and its place is taken by damp air from the neighbouring seas, which in its turn is forced to rise, expand, cool, and deposit its moisture as rain. Since the heating up of the plains of India is a fundamental portion of the mechanism that brings the moisture-bearing air from the south Indian Ocean across the equator to discharge its humidity as monsoon rainfall, it is natural to feel some confidence that years of high temperature in May will be years of good rainfall and *vice versâ*. But it was pointed out on page 12 of the monsoon forecast of 1901 that such is not the case, and a further examination of the question has confirmed the view—at any rate when the temperature is measured in the usual manner. The correlation coefficient of the average over India of temperature in May with the rainfall of the following monsoon from 1875 to 1905 is +·05, with a probable error owing to accidental causes of ·12. The data thus afford no support to the expectation that a hot May will be followed by an abundant monsoon.

9. Since the hottest region in the neighbourhood of India consists of northwest India and the desert regions beyond, it might be thought that any affect due to the heat might be better exhibited by taking the temperature of that area rather than that of the plains of India. Accordingly the mean of the May temperature departures* of Baghdad, Tehran, Ispahan, Bushire, Chaman, Quetta, Hyderabad (Sind), Deesa, Jacobabad, Multan, Dera Ismail Khan, Lahore, Sirsa, Jaipur, Allahabad and Jhansi have been correlated with the monsoon rainfall of India; and the resulting coefficient is only—·02, with a probable error of ·12. For the June temperature of the same area† the coefficient is —·17. Here also the effect of the heating cannot be found.

10. This paradox is not easy to explain satisfactorily, but there are reasons for ascribing it to our ignorance of conditions in the upper air. It has long been known that at times when sunspots are numerous the temperature of the air, as measured in the ordinary way, is lower than the average. There is fairly good evidence that at such times the sun's radiation is more powerful than usual, with the effect of creating stronger air currents, and consequently more moisture-laden air over continents. And if this be the case it would appear that it is the excess of moisture in the air that prevents the temperature near the ground level from rising. In order to test this I have compared the correlation coefficients with sunspot numbers of temperatures of places in which the moisture in the upper air is presumably abundant and of places where it is relatively scanty.

The month when the sun's radiation might be expected to have the best chance of raising the temperature of the Indian plains is January, for rainfall and cloud are at a minimum; but the humidity of the air is within 66 per cent of saturation and the relation of the temperature with the annual sunspot number is —·25. On the other hand if we consider May in the arid region represented by Baghdad, Bushire, Tehran, Ispahan, Chaman and Quetta the coefficient is only —·1. Further if we take the central Australian desert at its driest time, the coefficient with the sunspots of the mean temperature for June, July and August at Alice Springs and Charlotte Waters s+·2.

Apparently as humidity diminishes the coefficient of temperature with sunspots tends to become positive; and at times of increased solar radiation we should expect the air high up to be warmer although that near the ground may be cooler. It seems possible therefore that temperature in the upper air may be higher in years of abundant monsoon rainfall and that if we could measure it accurately we might derive knowledge of a factor with material influence on the monsoon rainfall of the country.

(c) *The effect on Indian monsoon rainfall of icebergs in the Southern Ocean.*

11. When at a loss for an explanation of the failure of the Indian rains several writers have put forward the suggestion that since an abundance of icebergs in the South Indian Ocean must exercise a marked effect on the temperature of that large region, it is possible that the number of icebergs may have a determining influence

* See Table VI.

† See Table VII.

upon the Indian monsoon. Accordingly when the London Meteorological Office recently published statistics of the observations of ice in the Southern Ocean from 1885 to 1912 an application was made to Dr. Shaw to allow the numbers for the South Indian, South Pacific and South Altantic Oceans to be separately tabulated. He kindly agreed and the result is contained in Table VIII and reproduced in Figure 8. It will be seen that in the South Indian Ocean (20°E to 110°E) the number of occasions on which ice is recorded may be described as small from 1888 to 1892, large in 1894, and very large from 1895 to 1897, small from 1898 to 1902, large in 1904, small in 1905 and 1906 and large in 1909. Thus ice was abundant in 1894 and 1909 when our rains were good, as well as in 1895, 1896 and 1904 when our monsoon was deficient, and in a similar way ice was scanty in 1889, 1890, 1892, 1898 and 1900, when our rainfall was above the average, as well as in 1891, 1899, 1901 and 1905, when the monsoon failed. It does not therefore appear that the ice in the South Indian Ocean exercises a material influence on the Indian monsoon.

The data for the South Atlantic Ocean are, however, more promising in this respect. Neglecting minor features in view of an inevitable amount of uncertainty in the data, it appears that the quantities of ice were small from 1885 to 1891, were large in 1892, very large in 1893* and did not again become really large before 1906. In that year and in 1908 very many observations are indicated, while there are many in 1910. But in 1907, 1909, 1911 and 1912 the number is not large.

If we now confine our attention to the southern seas in the neighbourhood of Cape Horn, Mossmann, who has collected a fairly complete set of meteorological observations from this neighbourhood for the years 1903 to 1908 remarks† an extraordinarily large number of icebergs in 1908 which he apparently regarded as the greatest outbreak of the period. Further detailed information regarding the neighbourhood of Cape Horn will be found in the Segelhandbuch für den Stillen Ozean‡ of the Deutsche Seewarte; and a few outbreaks of ice are indicated in Krummel's 'Handbuch der Ozeanographie'.§

From these sources it may be gathered that icebergs were extremely numerous from April to October 1892, from December 1892 to June 1893, from September 1893 to January 1894, and in 1908; and icebergs appear to have been fairly numerous from September 1868 to February 1870, from December 1874 to March 1875, September 1878 to April 1879, and in 1906. Smaller numbers of icebergs were reported locally from time to time, but the above are the most important cases. Now if we turn to the data of annual pressure at Santiago (Chili), Buenos Ayres and Cordoba (Argentine Republic) in Table IX we find that in the three years mostly affected, 1892, 1893 and 1908, the mean of the pressure departures of these places was + ·47mm., + ·77mm., and + ·51mm. Further in 1869, 1875, 1879 and 1906 the mean departures were + ·14mm., + ·32mm., — ·03 mm. and + ·05 mm., respectively. The number of years for which information is available is not large enough to justify a definite conclusion; but the data emphatically suggest that years of much ice off South America tend to

* The excess in 1892 and 1893 near Cape Horn is confirmed by the account on the back of the U. S. A. Pilot Chart of the North Atlantic Ocean for November 1896.

† Scottish Geographical Magazine, August 1909; see also Meteorologische Zeitschrift, 1910, page 35.

‡ Pages 834 to 838 in the edition of 1897.

§ In the chart on page 600 of Volume II (1911).

be years of high pressure in the Argentine Republic and Chili. We should accordingly expect them to be years of good rainfall in India; and it is interesting to see that in the monsoons chiefly affected, those of 1892, 1893 and 1908 there were excesses of 4″·93, 3″·64 and 2″·10; while in the years 1869, 1870, 1875, 1879, 1894* and 1906 less affected, the departures were — 0″·11, + 1″·42, + 4″·41, + 2″·28, + 4″·67 and — 0″·11. The mean departure of the first group is + 3″·56 and of the second group,* + 2″·09.

12. Since the behaviour of icebergs is of importance to navigators as well as to meteorologists, the bearing of the data of Table VIII on the question of the length of life of a berg may be considered. In the second edition of the 'Meteorological Charts of the Southern Ocean between the Cape of Good Hope and New Zealand' (London, 1907), page 8, it is said :—

"From the fact that many icebergs, some of very large dimensions, were reported northeast of the Falkland Islands before 1892, and that as ice was reported in increasing quantities, first west of the meridian of the Cape and then east of it, so the ice north east of the Falklands became less and finally disappeared, it seems not improbable that most of the ice reported in the last nine years† in the Southern Indian Ocean had drifted east from the area near the Falklands. If this was so, some idea of the life of a berg in temperate climates may be formed. It certainly cannot be considered as less than ten years, and its destruction is probably due more to wave action than increased warmth."

Again in the Additional Remarks of December 1906, given on page 10, it said :—

"Since the close of 1905, however, reports of ice observed in the neighbourhood of Cape Horn, and between that Cape and the Falkland Islands, have been increasingly frequent; and in recent months a large number of bergs have been seen as far as three hundred miles north of Falklands. It is, therefore, not improbable that at no distant date, ice, in large quantities, will again make its appearance in the South Indian Ocean, and seamen are cautioned accordingly."

It would appear that, natural as were the inferences drawn regarding the length of life‡ of icebergs and the distances travelled by them, these have not been substantiated by the recent data of the South Indian Ocean, where contrary to expectation but few icebergs have appeared. Further Dr. G. C. Simpson informs me that as a result of his experience in the Ross Sea he does not think it probable that a free berg can last longer than two years.

* The year 1894 has been included because of the fact that isolated bergs were reported from May onwards in addition to the large number in January. If it be excluded, the average departure of the second group becomes + 1″ 58.

† The extract is from remarks reproduced from the original edition of 1899.

‡ The view that in the southern seas icebergs may last as long as ten years is accepted by Dr. Krummel in his 'Handbuch der Oceanographie', Volume I, page 524. But he merely urges in its favour the immense area covered by some bergs not more than 300 feet high, and there is no actual record that the life of any of these exceeded four months.

TABLE I.

Departure from normal of monsoon rainfall of India, hill stations excluded.

Year.		0	1	2	3	4	5	6	7	8	9
		"	"	"	"	"	"	"	"	"	"
186	...	...	...	...	...	...	−0·75	−1·37	+1·19	−3·47	−0·11
187	...	+1·42	+1·76	+1·32	−2·25	+2·67	+4·41	−2·24	−7·12	+2·79	+2·28
188	...	−1·70	+1·85	+2·23	−1·33	+2·20	+0·42	−0·99	+1·40	−0·45	+2·23
189	...	+1·84	−2·90	+4·93	+3·64	+4·67	−2·67	−1·11	+0·45	+0·57	−7·03
190	...	+1·07	−4·55	−1·65	−0·39	−2·22	−2·91	−0·11	−3·12	+2·10	+2·03
191	...	+1·09	−3·92	−1·74	−1·86	...	...	...	...	...	...

TABLE II.

Annual pressure departure of India, hill stations excluded.

Year.		0	1	2	3	4	5	6	7	8	9
		"	"	"	"	"	"	"	"	"	"
186	...	...	...	...	...	...	+·014	+·008	+·016	+·019	−·001
187	...	−·010	−·001	−·004	−·014	+·001	−·017	−·007	+·022	+·002	−·014
188	...	−·003	+·002	−·010	−·005	+·010	+·014	−·003	−·010	+·011	−·004
189	...	−·003	+·010	−·022	−·001	−·012	+·023	−·001	−·005	−·018	+·004
190	...	+·010	+·005	+·011	+·001	−·003	+·009	−·012	+·002	·000	−·004
191	...	−·013	·000	+·009	...	...	...	...	...	...	...

TABLE III.

Mean of annual pressure departures of Calcutta, Bombay and Madras.

Year.		0	1	2	3	4	5	6	7	8	9
		"	"	"	"	"	"	"	"	"	"
186	...	...	...	...	...	...	+·015	+·008	+·010	+·021	−·001
187	...	−·016	−·006	−·009	−·002	+·001	−·007	−·005	+·040	+·001	−·013
188	...	−·001	+·002	−·012	−·005	+·013	+·015	−·009	−·007	+·011	·009
189	...	−·006	+·013	−·019	+·003	−·009	+·007	+·003	−·004	−·015	+·011
190	...	+·012	+·005	+·013	−·001	+·003	+·018	−·001	−·005	−·002	−·009
191	...	−·016	+·001	+·005	...	...	...	...	...	...	...

TABLE IV.

Correlation coefficients of the monsoon rainfall of any year with the monthly pressures of India in the second year before, year before, actual and following years.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	"	"	"	"	"	"	"	"	"	"	"	"
Second year before*	—·1[illegible]	—·212	—·19[illegible]	—·143	—·152	—·071	—·200	+·325	—·050	+·232	+·137	+·254
Year before ...	+·243	+·245	+·17[illegible]	+·227	—·0[illegible]	+·223	+·240	+·103	+·008	—·053	+·034	+·264
Actual year ...	—·167	—·228	—·240	—·240	—·150	—[illegible]	—·123	+·061	—·016	—·153	—·192	—·103
Following year ...	—·1[illegible]	—·144	—·231	—·[illegible]	—·470	—·229	+·0[illegible]	—·002	—·037	—·071	+·231	+·253

TABLE V.

Mean pressure departure of India for the ten months ending on 30th August.

Year	0—1	1—2	2—3	3—4	4—5	5—6	6—7	7—8	8—9	9—0
	"	"	"	"	"	"	"	"	"	"
18[illegible] ...		...			+·021	+·031	+·015	+·028	+·007	—·013
187 ...	+·0[illegible]	+·0[illegible]2	—·016	+·0[illegible]	—·007	—·011	+·0[illegible]5	+·020	—·023	—·015
18[illegible] ...	+·01[illegible]	—·0[illegible]	—·011	+·007	+·017	+·031	—·010	+·003	+·016	—·017
18[illegible] ...	+·0[illegible]	—·016	—·0[illegible]	—·007	+·003	—·005	—·003	—·015	—·011	+·030
19[illegible] ...	[illegible]	+·0[illegible]	+·011	—·012	+·013	+·0[illegible]5	+·005	—·001	+·001	—·010
191 ...	+·004	+·007	+·0[illegible]	...		...	...	...	...	...

TABLE VI.

Table of mean May temperature departures of Baghdad, Bushire, Tehran, Ispahan, Chaman, Quetta, Lahore, Dera Ismail Khan, Jacobabad, Jaipur, Sirsa, Deesa, Hyderabad, Multan, Allahabad and Jhansi.

Year.	0	1	2	3	4	5	6	7	8	9
	°	°	°	°	°	°	°	°	°	°
187 ...	..	..	...	.	...	0	+0·7	—3·9	—2·7	0
188 ...	+0·5	+0·6	—1·3	—1·2	—0·7	—0·4	0	+1·2	—0·1	—1·1
189 ...	+0·1	—2·0	+1·4	—0·6	+0·7	+2·1	+0·9	+2·1	—0·3	+2·2
190 ...	—0·7	0	+2·1	—0·8	+0·6	+1·6	+1·7	—2·1	—0·5	—0·8
191 ...	+0·2	+0·4	+0·5	...	...	...	...	...	...	...

TABLE VII.

Table of mean June temperature departures of Baghdad, Bushire, Tehran, Ispahan, Charan, Quetta, Lahore, Dera Ismail Khan, Jacobabad, Jaipur, Sirsa, Deesa, Hyderabad, Multan, Allahabad and Jhansi.

Year.		0	1	2	3	4	5	6	7	8	9
		°	°	°	°	°	°	°	°	°	°
187	..	...	...	...	...	..	+ 2·1	+ 0·4	− 0·4	+ 0·8	− 1·7
188	...	+ 0·4	− 1·1	− 0·9	+ 0·3	− 1·6	− 1·8	− 1·1	− 1·1	0	+ 0·4
189	...	0	+ 0·7	− 0·3	− 1·9	− 0·9	− 0·2	+ 0·1	+ 0·2	+ 1·0	− 0·5
190	...	+ 1·2	+ 1·7	+ 0·8	+ 1·9	+ 0·2	+ 1·4	− 0·2	− 1·6	+ 0·8	− 0·5
191	..	− 0·6	− 0·2	+ 1·7	...	..	...	...	...	...	...

TABLE VIII.

Numbers of icebergs reported annually.

South Indian Ocean.

Year.		0	1	2	3	4	5	6	7	8	9
188	...	...	...	...	..	...	...	...	...	2	3
189	...	6	3	2	10	26	63	52	16	3	6
190	...	7	2	4	12	22	1	5	8	8	16
191	...	7	...	2	...	.		...	.	.	...

South Atlantic Ocean.

Year.		0	1	2	3	4	5	6	7	8	9
188	...	...	...	...	..	...	1	2	7	1	2
189	...	5	15	83	235	21	6	1	1	2	9
190	...	3	9	33	29	13	7	271	15	127	23
191	...	61	15	13	..	...	.	...	...	..	..

TABLE VIII.—*concld.*

South Pacific Ocean.

Year.		0	1	2	3	4	5	6		8	9
188	..	...	...	...	..	—	...	...	1	2	1
189	..	3	3	21	12	13	12	1	1	9	9
190	...	5	20	15	10	17	4	28	1	36	21
191	..	20	42	9	...	...				...	.

TABLE IX.

Departures of annual pressure at—

Santiago.

Year.		0	1	2	3	4	5	6		8	9
		mm.	mm.	mm.	mm.	mm.	mm.	mm.		mm.	mm.
186	...	...	+ 0·46	+ 0·31	— 0·03	— 0·16	+ 0·07	+ 0·08	+	— 0·28	+ 0·14
187	...	+ 0·08	+ 0·05	+ 0·05	+ 0·73	+ 0·36	+ 0·04	— 0·50	—	+ 0·02	+ 0·09
188	...	— 0·23	— 0·15	— 0·04	— 0·29	— 0·45	— 0·31	+ 0·23	—	— 0·01	— 0·05
189	..	+ 0·15	— 0·01	+ 0·21	+ 0·45	+ 0·27	+ 0·13	— 0·21	+	— 0·09	— 0·07
190	..	— 0·23	+ 0·02	— 0·26	+ 0·01	— 0·31	— 0·18	+ 0·33	+	+ 0·20	+ 0·36
191	...	+ 0·23	+ 0·14	— 0·46		...		...		..	.

Buenos Aires.

Year.		0	1	2	3	4	5	6	8	9
		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
187	.		.	..	..	+ 1·35	+ 0·41	— 0·05	—– 0·09	— 0·28
188	...	— 0·70	— 0·68	— 0·17	— 0·33	— 0·21	— 0·33	+ 0·03	—– 0·51	— 0·05
189	...	+ 0·18	— 0·02	+ 0·28	+ 0·87	+ 0·15	+ 0·11	+ 0·29	+ 0·14	— 0·49
190	.	— 0·19	+ 0·46	— 0·26	— 0·11	+ 0·04	— 0·45	— 0·45	+ 0·51	+ 0·33
191	...	+ 0·17	+ 0·13	...	...	...		.	...	